

(19) World Intellectual Property
Organization
International Bureau



10/534498



(43) International Publication Date
27 May 2004 (27.05.2004)

PCT

(10) International Publication Number
WO 2004/044525 A3

(51) International Patent Classification⁷: G01C 3/10

(21) International Application Number:
PCT/GB2003/004898

(22) International Filing Date:
11 November 2003 (11.11.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0226242.6 11 November 2002 (11.11.2002) GB

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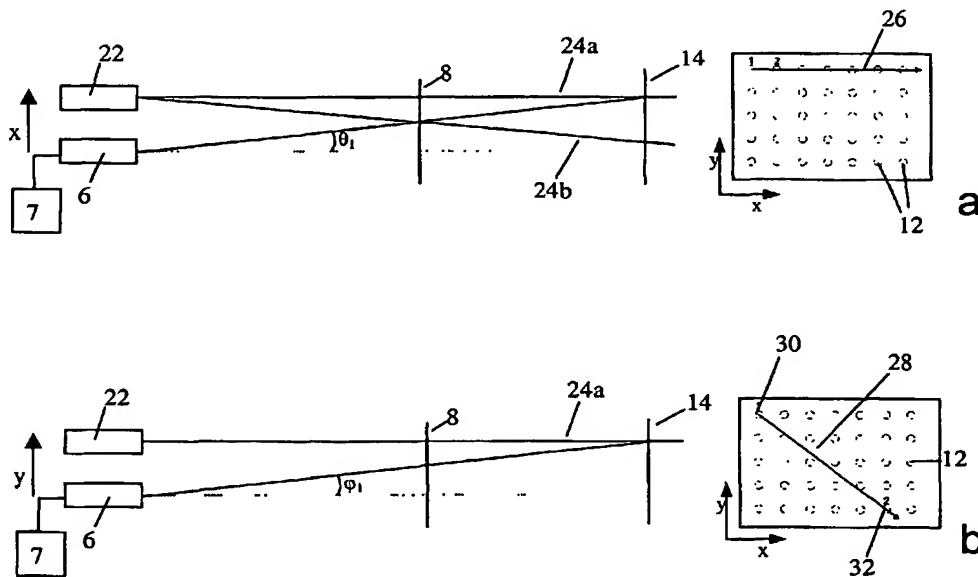
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(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (regional): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: RANGING APPARATUS



(57) Abstract: This invention relates to a ranging apparatus capable of ranging simultaneously to a three dimensional scene. An illumination means (22) illuminates a scene with a two dimensional array of spots (12). A detector (6) is located near to the illumination means (22) and arranged to look toward the scene. A processor (7) responds to the output from the detector (6) and, from the location of a spot in the image of the scene, determines the range to that spot. A variety of techniques are used to resolve ambiguity in determining which projected spot is being considered.



Declaration under Rule 4.17:

- *of inventorship (Rule 4.17(iv)) for US only*

Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(88) Date of publication of the international search report:

16 September 2004

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 03/04898

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G01C3/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G01C G01S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 294 544 A (ALTSCHULER MARTIN D ET AL)	1,5,16,
Y	13 October 1981 (1981-10-13)	48,54,55
	column 2, line 20 - line 45	10,11,
		13,14,
		17,
		20-22,
		24,25,
		27,57,59
A	column 6, line 55 - line 59	19,33,
	-----	49-53
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

A document defining the general state of the art which is not considered to be of particular relevance

E earlier document but published on or after the international filing date

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O document referring to an oral disclosure, use, exhibition or other means

P document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

18 June 2004

Date of mailing of the international search report

09.07.2004

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INTERNATIONAL SEARCH REPORT

International Application No.
PCT/GB 03/04898

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A Y Y A X Y X Y Y A Y X Y X Y	<p>US 4 867 570 A (SORIMACHI KANEHIRO ET AL) 19 September 1989 (1989-09-19) column 4, line 31 - line 50</p> <p>-----</p> <p>US 6 160 479 A (AAHLEN HANS ET AL) 12 December 2000 (2000-12-12) column 2, line 14</p> <p>-----</p> <p>US 6 147 760 A (GENG ZHENG JASON) 14 November 2000 (2000-11-14) column 1, line 41 - line 61 column 2, line 19 - line 51 column 3, line 2 - line 18</p> <p>-----</p> <p>US 5 726 443 A (CHAPMAN GLENN H ET AL) 10 March 1998 (1998-03-10)</p> <p>column 7, line 12 - column 8, line 58 column 9, line 6 - line 19 column 15, line 10 - line 19 column 15, line 30 - line 40</p> <p>-----</p> <p>DE 101 49 750 A (TECMATH AG) 19 September 2002 (2002-09-19)</p> <p>page 1, line 30 - line 35 page 2, line 5 - line 58</p> <p>-----</p> <p>EP 1 134 595 A (OMRON TATEISI ELECTRONICS CO) 19 September 2001 (2001-09-19)</p> <p>column 2, line 39 - line 47 column 3, line 36 - line 50</p> <p>-----</p> <p>US 5 175 601 A (FITTS JOHN M) 29 December 1992 (1992-12-29) column 3, line 21 - line 28</p> <p>-----</p> <p>US 5 675 407 A (GENG ZHENG JASON) 7 October 1997 (1997-10-07) column 2, line 10 - line 23 column 2, line 59 - column 3, line 6</p> <p>-----</p> <p>US 5 003 166 A (GIROD BERND) 26 March 1991 (1991-03-26) column 1, line 33 - line 40</p> <p>-----</p>	<p>1,2,4-6, 16,54,55 10,11, 13,14, 17, 20-22, 24,25, 27,57,59 19,49-53</p> <p>17</p> <p>10,11,57</p> <p>3,56</p> <p>1,2,10, 11,33, 35,36,57 37</p> <p>1,2, 10-12, 20-25, 27,58-60 26</p> <p>20-22, 24,25, 27,59 23,58,60</p> <p>26</p> <p>1,2,13, 14 10,11,15</p> <p>1,2,13, 14 15</p>

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 03/04898

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/016631 A1 (MARCHITTO KEVIN S ET AL) 7 February 2002 (2002-02-07) page 2 - page 3	1,2, 13-15
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Y	US 6 377 353 B1 (ELLIS JAMES S) 23 April 2002 (2002-04-23)	37
A	column 6, line 46 - line 56; figures 1,6	33,38,39

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 03/04898

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-6, 16-19, 48-53, 54, 55, 56

Ranging apparatus in which the spots are arranged in a particular way and focused / unfocused spots are used to distinguish between different distances

2. claims: 7-9, 28-32, 47

Use different spot arrays and (periodically) alter the arrays to avoid ambiguity

3. claims: 10-12, 57

Use spot characteristics as colour or shape to avoid ambiguity

4. claims: 20 - 27, 58 - 62

Use imaging from several directions to avoid ambiguity

5. claims: 13 - 15

Produce spots as intersections between lines

6. claims: 33 - 46

Produce spots with a particularly shaped light-guide

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 03/04898

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